

[0024] Dimensions herein are provided for illustration only and do not limit the invention. However, existing garment button hole and button sizes are near-standard on many shirts, and dimensions suitable for use with these standard buttons may be provided as illustrative examples. Unless the context clearly requires otherwise, when dimensions or other values are modified by the word “about”, this refers to a variation of no more than  $\pm 20\%$ . Likewise, “substantially”, “substantially all” and similar variations, means no less than 90%, unless the context clearly requires otherwise.

[0025] The magnetic fastener of the invention comprises a button cover and a button hole engagement member attached by magnetic force. The two components together may be referred herein to as an “apparatus”, a “magnetic button system”, or simply a “fastener”.

[0026] FIG. 1 depicts an embodiment of button hole engagement member 10 (also referred to herein as the “front piece”) which includes button portion 11 and backing portion 12 connected by post 13, which is shown in the side view of FIG. 2. When button hole engagement member 10 is inserted into a button hole of a shirt front, for example, button portion 11 and backing portion 12 are on opposite sides of the shirt placket. Button portion 11 faces frontward and is visible, having the appearance of a button, or other ornamental design, left to the choice of the designer. For example, where the system is used with a typical man’s shirt, button portion 11 must be able to slide through the button hole and may mimic the size and appearance of a button, having a diameter of about 10 mm. This also ensures that button portion 11 is large enough not to slip through the button hole too once button hole engagement member 10 engages the button hole. Backing portion 12 is also large enough not to slip through a button hole; but is also preferably larger than button portion 11 to assist in engaging button cover 20 in FIG. 4 with magnetic force, as described below. In embodiments, the rear of backing portion 12 is a circle having a diameter of about 26 mm. Post 13, shown in the side view of FIG. 2, has a width conveniently secured in a button hole. Certain embodiments according to the invention include a taper on post 13 which may result in less movement of engagement member 10 in the button hole. In embodiments, the height of the front piece, D1 in FIG. 2, may be about 8 mm to about 12 mm.

[0027] The cross sectional view of FIG. 3 shows recess 15 receiving a magnetic or ferromagnetic member 14. In embodiments, the magnetic or ferromagnetic member 14 may be a metal disk, and may be coated with an oxidation layer or lamination to prevent corrosion. The ferromagnetic member preferably covers a large area facing the button cover and forms a layer to facilitate magnetic attraction and interlocking of button cover 10 in the recess 15. The ferromagnetic member may also be completely encapsulated in button hole engagement member 10, which may enable the device to be made waterproof. In embodiments, the entire area of recess 15 and substantially all of the rear surface is covered by a thin ferromagnetic disk. In one embodiment, shown in FIG. 3, member 14 is a metal disk, about 0.25 to about 2.0 mm thick, and if a magnet is used may be about 1 to 3 mm. However, in other embodiments, the member 14 may be a permanent magnet and may have different dimensions.

[0028] In the embodiment shown, edge 31 on the rear periphery of button hole engagement member 10 forms a

bezel adapted to engage disk 14. Peripheral rear edge 31 of the button hole engaging member may also serve to guide button cover 20 (shown in FIG. 4) to the closed position and mate with button cover in the closed position. This mating engagement results in a tactile sensation of the button being closed when it is attached to the front piece by magnetic force, which may have advantages for those with reduced motor ability.

[0029] FIG. 4 depicts button cover 20 which encloses a permanent magnet according to one embodiment of the invention. Button cover 20 has an opening that receives the button attached to an existing garment. Button cover 20 may completely encapsulate the magnet(s) so that the device may be made waterproof.

[0030] In the embodiment shown in FIG. 4, button cover 20 comprises two semi-circular halves 21, 22 joined by a hinge. For this purpose, polycarbonate or other polyester, or other resin may be used, known in the art to be used for like fittings. In embodiments a metal fitting, or a fitting having metal in it, may be used. Semicircular button cover halves 21, 22 include an opening 26 (shown in FIG. 5) in a side surface which is completely closed when the button on the existing garment is enclosed therein. The halves are joined by a latch closure 24, 25 in the closed state. FIG. 6 is a cross sectional view of the button cover element along lines C-C of FIG. 5, showing opening 26 (as in FIG. 5) where a button on an existing garment is received. FIG. 6 is a side view of the button cover of FIG. 4, showing the interior space 39 where a button is received. Aperture 32 in FIG. 5 is formed on a rear surface of button cover 10 to accommodate button threads attaching the existing button to the garment.

[0031] In an alternative embodiment shown in FIG. 9, FIG. 10 and FIG. 11, button cover 200 in FIG. 10 comprises a central opening 209 in a rear surface thereof for receiving a button on an existing garment. One or more flexible members 203 in FIG. 11 on a periphery of opening 209 in FIG. 10 are adapted to flex and ride over the button and grip the button when button cover 200 encloses the button. Annular space 202, defined between wall 201 around opening 209 (shown in FIG. 10) and wall 204 on the periphery of the button cover, houses one or more permanent magnets 207 in FIG. 9 which applies a magnetic force on button hole engagement member 100 in FIG. 9. The thickness dimension D6 of wall 204 is about 1 mm in the embodiment shown, and wall 201 may have a similar dimension, but these dimensions are not critical.

[0032] In an embodiment shown in FIG. 8A and FIG. 8B, opening 82 is provided on the side of the button cover 81, and front and back magnets 85, 86 are provided to apply force between button cover 81 and button hole engagement member 84. Spacer 83 secures button cover 81 to an existing button 87.

[0033] In the embodiment of FIG. 6, the permanent magnet comprises two annular neodymium magnets 27 arranged around cavity 39, where the existing garment button is received. The neodymium magnets, with the dimensions shown, and provided a ferromagnetic disk as shown, are sufficient to provide a pulling force of 2 lbs or greater.

[0034] The method of using the magnetic button system described above to retrofit a shirt, vest or other garment for use by a person with reduced motor ability involves simply installing a button cover as described above so that it encloses a button attached to an existing garment and so that a surface area of the enclosed magnet faces frontward. The